REMARKS

The Examiner has rejected the claims over the combination of Smith and the newly cited patent to Stone. Applicant submits that the pending claims are allowable for two reasons. First, Applicant will show that the newly cited reference is non-analogous art, and is not properly combined with Smith under Section 103. Secondly, Applicant submits that the structure now recited in the claims renders the patent to Stone inapplicable to the present invention.

Stone concerns threaded pipe joints. The object of Stone's invention is to make a threaded, tubular joint more leak resistant. Such a joint is formed by mating threaded surfaces, one on the male portion and one on the female portion. These threads serve a dual purpose. First, they hold the two portions of the joint together mechanically, like a threaded bolt holds a nut. Secondly, the threads themselves comprise a seal, the threads of one pipe section pushing against the threads of the other pipe section to prevent leakage of oil.

The mechanism of sealing, in a threaded joint, relies on a tight fit between the threaded surfaces. In theory, tightening the male and female portions together should cause the threaded surfaces of each portion to press against the other sufficiently to prevent leakage of fluid between them.

In practice, however, threaded seals are prone to leakage, sometimes substantially. When the threaded joint is assembled, a small helical path is formed between the crest of one thread and the valley of the opposing thread it is mated against. This helical path provides a means for leakage. The leakage can be substantial at high pressures, or it can become substantial over time as the leaking fluid erodes a larger path.

In the art of threaded seals, it has been known to apply sealing material, such as Teflon tape, paste, or pipe dope, to the threads, prior to assembly, in an attempt to fill the helical space and prevent leakage. These techniques have not been particularly successful.

Stone's invention, dating from the post-World War II era, attempts to solve the problem of leakage in a similar manner. In particular, Stone proposes inserting a rubber plug between the mating threads of the portions of a pipe joint, so as to seal the threads more fully.

The use of threaded connections as a sealing means is a notoriously poor choice in high-pressure systems such as those for which the present invention is intended. Indeed, since the time the Stone invention was made, there has been a trend away from threaded seals in the hydraulic industry, especially in high-pressure systems.

The modern solution to the leakage problem is to use face to face sealing with an O-ring, instead of threaded connections. In an O-ring seal, as is used in the present invention, the sealing effect is not produced by threads, but by firmly holding the planar end surfaces of a hydraulic component against an O-ring.

Stone's solution to the problem of leakage is to cut a hole in the thread, and to place a rubber plug in that hole. In theory, the rubber is forced by hydraulic pressure against the walls of the threads, and causes the joint to be better sealed.

However, the formation of the hole, in Stone, itself introduces a potential leakage path, namely between the fluid cavity and the helical space defined by the threads. Stone attempts to use the rubber plug to seal this path as well, and the plug must therefore seal against multiple, non-planar surfaces, as well as the walls of the hole and the helical space

between the threads, making it difficult to obtain a truly effective seal.

The O-ring seal used in the present invention is intended to seal only against two opposing, parallel, planar mating surfaces. The O-ring is mounted within an opening in the sealing plate, and the fluid being contained never "sees" the top side (the outer circumference) of the O-ring. This feature alone contrasts with Stone, which relies on sealing at the top surface of the rubber plug.

The support ring which holds the O-ring is non-threaded. It is not screwed into anything, and does not itself constitute a seal. Its purpose is to hold the O-ring in place, and to separate the O-ring from the fluid cavity, and prevent the O-ring from being drawn into the cavity during states of high flow. It also seves as a mechanical support for the opposing mating surfaces.

The patent to Smith, like the present invention, uses an annular seal, not a threaded seal. In that regard, it uses the same general catagory of seal as is used in the present invention, although it does not show or suggest a support ring having an orifice, as has been recognized by the Examiner.

Because Smith deals with an O-ring seal, and Stone deals with a threaded seal, the two references are non-analogous. As explained above, threaded seals are disfavored in the modern art of containing high-pressure hydraulic fluids. A person skilled in the art at the time the present invention was made would not have looked to a half-century old reference, showing a discredited technique of sealing, for guidance on how to seal a fluid connection in a system using an O-ring. For this reason alone, Applicant submits that Smith and Stone are not properly combinable under Section 103.

To emphasize the distinction between the annular seal of the present invention, and the threaded seal of Stone, Applicant has amended the claims to recite that the plate provides a non-threaded fluid seal, and that the support ring is non-threaded. Support for these limitations is found in the drawings, which clearly show a non-threaded seal and a non-threaded support ring.

Thus, even if Stone were combined with Smith, the result would not be the invention as claimed. In Stone, the orifice cited by the Examiner is formed in a threaded member. In the present invention, the orifice is formed in a non-threaded member. To combine Stone with Smith, one would have to disregard the teaching of Stone that the orifice should be formed in a threaded member. For this additional reason, Applicant submits that the pending claims are not obvious.

Furthermore, in the present invention, the orifice is formed in a non-threaded support ring. In Stone, the orifice is formed at an end of one of the pipes to be joined, and not in a support ring. Stone does not have a structure which is analogous to the support ring of the present invention. Thus, since the orifice in Stone is formed in a member which has no analog in the present invention, the combination of Stone with Smith under Section 103 is unwarranted. The present claims, as amended, define structure which directly contradicts the teachings of Stone.

In short, Stone shows an orifice, but not an orifice in a non-threaded support ring. The references cannot be combined without disregarding the teachings of at least one of them. The proposed combination of the orifice of Stone with the structure of Smith therefore represents an impermissible reconstruction of the invention by hindsight, and is not warranted by Section 103.

Since all of the independent claims have been amended as described above, Applicant submits that all of the claims define a patentable invention over Smith and Stone.

Finally, Applicant notes that the recitation of a non-threaded seal is not intended to imply that threaded connections cannot be used elsewhere, for purposes other than sealing. In particular, the sealing plates of the present invention have bolt holes, through which conventional threaded connections are made, to hold the plates in place. But these threaded connections have no effect on the hydraulic sealing which, in the present invention, relies solely on the O-ring, and not on any threaded seal.

Version of Claims with Markings to Show Changes Made

1. (Three Times Amended) In a one-piece plate for providing a non-threaded fluid seal between two port faces, the plate including an interior opening having a boundary and a one-piece annular seal disposed within the boundary of the opening,

the improvement comprising a non-threaded support ring disposed within the annular seal,

wherein the support ring has an outside diameter which is greater than an inside diameter of the seal and less than an outside diameter of the seal,

wherein the support ring includes at least one orifice which provides a fluid connection between said opening and said annular seal.

23. (Amended) In a plate for providing a non-threaded fluid seal between two port faces, the plate including an opening having a boundary and an annular seal disposed within the boundary of the opening,

the improvement comprising a non-threaded support ring disposed within the annular seal, wherein the support ring includes at least one orifice which provides a fluid connection between said opening and said annular seal.

24. (Amended) In a plate for providing a non-threaded fluid seal between two port faces, the plate including an opening having a boundary and an annular seal disposed within the boundary of the opening,

the improvement comprising a non-threaded support ring disposed within the annular seal,

wherein the support ring has an outer boundary which faces an inner border of the annular seal, and wherein the support ring is chamfered on said outer boundary,

wherein the support ring includes at least one orifice which provides a fluid connection between said opening and said annular seal.

25. (Amended) A plate for providing a non-threaded fluid seal between two port faces, comprising:

a) an opening formed in the plate, the opening having a boundary,

b) an annular seal disposed within the boundary of the opening, and

c) a non-threaded support ring disposed within the annular seal,

wherein the support ring includes at least one orifice which provides a fluid connection between said opening and said annular seal.

26. (Amended) A plate for providing a non-threaded fluid seal between two port faces, comprising:

a) an opening formed in the plate, the opening having a boundary,

b) an annular seal disposed within the boundary of the opening, and

c) a non-threaded support ring disposed within the annular seal,

wherein the support ring has an outer boundary which faces an inner border of the annular seal, and wherein the support ring is chamfered on said outer boundary,

wherein the support ring has two chamfers, both chamfers making an angle of about 45° with an axis of the support ring, and

wherein the support ring includes at least one orifice which provides a fluid connection between said opening and said annular seal.

Please cancel Claim 27, without prejudice.